

# Guidance for Industry

## EFFICACY OF ANTHELMINTICS: GENERAL RECOMMENDATIONS

### DRAFT GUIDANCE

This guidance is intended to standardize and simplify methods used in the evaluation of new anthelmintics submitted for approval to the European Union, Japan, and the United States.

This guidance represents the agency's current thinking on the efficacy of anthelmintics concerning products regulated by the Center of Veterinary Medicine, FDA. It does not create or confer any rights for or on any person and does not operate to bind FDA or the public. An alternative approach may be used if such approach satisfies the requirements of the applicable statute, regulation, or both.

Comments and suggestions regarding the document should be submitted to Dockets Management Branch (HFA-305), Food and Drug Administration, 5630 Fishers Lane, Rm. 1061, Rockville, MD 20852. All comments should be identified with the Docket No. 99N-[insert number when assigned].

For questions regarding this document, contact Thomas Letonja, Center for Veterinary Medicine, (HFV-130), Food and Drug Administration, 7500 Standish Place, Rockville, MD 20855, 301-594-1656, E-mail: tletonja@cvm.fda.gov.

**U.S. Department of Health and Human Services  
Food and Drug Administration  
Center for Veterinary Medicine  
July 1999**

# **EFFICACY OF ANTHELMINTICS: GENERAL RECOMMENDATIONS**



Recommended for Consultation  
at Step 4 of the VICH Process  
on 22 October 1998  
by the VICH Steering Committee

THIS GUIDANCE HAS BEEN DEVELOPED BY THE APPROPRIATE VICH EXPERT WORKING GROUP AND IS SUBJECT TO CONSULTATION BY THE PARTIES, IN ACCORDANCE WITH THE VICH PROCESS. AT STEP 7 OF THE PROCESS THE FINAL DRAFT WILL BE RECOMMENDED FOR ADOPTION TO THE REGULATORY BODIES OF THE EUROPEAN UNION, JAPAN, AND USA.

# **EFFICACY OF ANTHELMINTICS: GENERAL RECOMMENDATIONS**

**Endorsed by the VICH Steering Committee at Step 3 of the VICH Process**

**22 October 1998**

## **General Anthelmintic Guidelines**

Two sections have been identified in the guidelines: general elements, and specific evaluation studies. The **General Elements** section includes: good clinical practice, evaluation of effectiveness data, types of infection and parasite strains, product equivalence, recommendations for the calculation of effectiveness, standards of effectiveness and the definition of helminth claims. The **Specific Evaluation Studies** section describes: dose determination, dose confirmation, field and persistent efficacy studies.

### **A. General Elements**

#### **1 - Good Clinical Practice**

The principles of Good Clinical Practice (GCP) should apply to all clinical studies and sponsors should work within the principles of the GCP recommendations.

#### **2 - The evaluation of effectiveness data, use of natural or induced infections, definition of laboratory and field (helminth) strains**

The evaluation of effectiveness data is based on parasite counts (adults, larvae) in dose determination and dose confirmation studies; egg counts/larval identification is the preferred method to evaluate the effectiveness in field studies. Controlled and critical tests are acceptable both for the dose determination and dose confirmation studies. However, controlled tests are preferable, and the option to utilize critical tests should be supported with an explanation from the sponsor.

The use of natural or induced infections in effectiveness studies will be determined by the type of parasite and the claim proposed by the sponsor. In some rare, but epizootologically important parasites, the use of induced infections is the only solution.

Recent field isolates generally are preferred to develop induced infections, although in some cases laboratory strains can be used (see glossary). Field strains are believed to reflect more accurately the current status of the parasite in nature. The characterisation of each of the laboratory isolates used in the investigations should be included in the final report i.e. source, maintenance procedure, drug sensitivity, number of passages and expected establishment rates in the target host. For field isolates, characterisation also needs to include source, date, location of isolation, previous anthelmintic exposure and maintenance procedure.

#### **3 - Product equivalence**

The principle of product equivalence can be used for alternative formulations of the same approved drug, when used at the same dose, the same route of administration and in the same

host. For a formulation change to a product with the same approved drug the pharmacokinetic attributes of the drug should dictate the study type that should be conducted for product equivalence. If the product is not, or is poorly absorbed, two dose confirmation studies using the dose-limiting parasite should be conducted. For absorbed drugs that can be measured in the blood plasma, a pharmacokinetic study may be sufficient.

For drugs (anthelmintics) that achieve measurable blood plasma levels, and for which a relationship with effectiveness can be correlated with pharmacokinetic parameters, a blood level bioequivalence study may be used rather than two dose confirmation studies.

For different formulations (generic copies) of existing registered product formulations, reference is made to bioequivalence requirements of each regulatory agency.

#### **4 - Recommendations for the calculation of effectiveness**

The analysis of parasite data in support of effectiveness uses estimations of several parasitological parameters including faecal egg counts and worm counts, which may be a reflection of the success of the treatment. In most natural infections, and less in induced infections, large variations in data values between similarly treated animals have been observed. This may require additional studies to be conducted to increase the number of observations.

##### **4.1 Data analysis recommendations**

It was proposed that the statistical analysis of the study would be a two-stage procedure. The recommendations were that the requirements for approval of an anthelmintic product should be based on significant statistical differences between the treated and control groups and on calculated percent effectiveness of 90% or more.

The statistical analyses should be determined by the sponsor in the protocol stage prior to any data analyses. Nonparametric or parametric procedures are acceptable. If the sponsor is able to demonstrate significant statistical differences between the treated and control groups, then percent effectiveness would be calculated using geometric means. For a product to be acceptable, the calculated percent effectiveness should be at least 90% (see Standards of Effectiveness).

##### **4.2 Geometric versus arithmetic means**

Disagreements based on differences in effectiveness are seen when either geometric or arithmetic means are used. However, in the context of harmonization, recommendations are needed for one method of calculating the means. Log-transformed parasite counts or egg-counts tend to follow a normal distribution more closely than do non-transformed parasite counts. Relative to the arithmetic mean, the geometric mean is therefore a more appropriate estimate of central tendency and has less potential for misinterpretation. The use of arithmetic means to evaluate effectiveness has been considered to be a more stringent criterion reflected in a more conservative estimation of therapeutic activity of the product.

For the calculation of percent of effectiveness geometric means are required for dose determination, dose confirmation, field trials and persistent efficacy studies. In certain circumstances there may be conditions acceptable for the use of arithmetic means.

##### **4.3 Number of animals (dose determination, dose confirmation and persistency trials)**

The minimum number of animals used per experimental group is a critical point. Although the number of animals will depend on the possibility to process the data statistically according to the adequate statistical analysis it has been recommended, to achieve a harmonization, that the inclusion of at least six animals in each experimental group is a minimum.

#### **4.4 Pooling data**

For sponsors intending to pool data it is important to ensure that a general protocol is standardized for each type of study proposed, that is dose confirmation, field and persistency studies. There should be similarity among numbers of animals/group numbers of parasites, type of animals and experimental conditions. Pooling data is allowed but the above criteria should be stringently met. The total number of studies conducted should include 12 adequately infected control animals i.e., 6 animals in at least 2 trials and an equal number of treated animals (i.e. a total of 24 infected animals) for each parasite species. In the case of rare parasites an alternative approach should be used (i.e. more trials may be required).

The geometric means are calculated based on all controls values, i.e. dropping zero counts in control groups and a corresponding number of zero treated animals will not be allowed.

#### **4.5 Adequacy of infection**

A universal definition of adequacy of infection cannot be formulated because of the diversity of genera, species and strains of helminths subject to evaluation. Furthermore, each strain under test may have unique characteristics of infectivity and pathogenicity. However, in the development of study protocols the adequacy of infection should be addressed, especially in terms of the statistical, parasitological and clinical relevance of the infection level in individual control animals, as well as the number of control animals in which infections are established. The level of infection, and its' distribution, among control animals should be adequate to permit the appropriate standards of efficacy to be met with acceptable statistical and biological certitude/confidence. Multiple infections are acceptable, however, each helminth species should reach acceptable minimums of infection.

In cases where all animals in the control group are infected, then *one possible* statistical method involves the use of calculating the lower 95% confidence limit of the control group geometric mean burden. If this value is greater than 10% of the control group geometric mean burden, then the infection can be said to be adequate. In the case where some of the animals in the control group are not infected (counts=zero) then the geometric means should be replaced by the median and the 95% confidence limit will be based on the control group median burden. However, whatever statistical method may be recommended, adequate infections are still required in (a minimum of) six control animals.

#### **4.6 Aliquot size**

Aliquot size to determine parasite burdens should be at least 2%. Smaller aliquot size may be used with justification.

### **5 - Standards of Effectiveness**

A compound should be declared effective only when effectiveness against each parasite declared on the labelling stands at 90% or above, based on calculation of geometric means using pooled data, and there is a statistically significant difference in parasite numbers between control and treated animals. The requirement of 90% efficacy refers to the overall efficacy from the combined analysis, and it is not required that every individual trial in the combined analysis has 90% efficacy. However, there are regional differences where the epizootiology of certain parasitic infections may require higher minimal effectiveness, especially when the aim for drug effectiveness is focussed specifically on preventing pasture contamination. These will be covered in the individual host species guidelines. In contrast, effectiveness below 90% may be adequate when the claimed parasites do not have any other effective treatment.

## **6 - Definition of Helminth claims**

Parasite identification will determine the type of claim proposed on the labelling. A species claim is highly recommended. However, a genus claim should be acceptable on the assumption that generally speaking there is more than one species in that genus. If species claims are to be made then the presence of each should be confirmed including two dose confirmation studies for each parasite.

### **B. Specific evaluation studies**

Three types of evaluation studies are used in the evaluation of all new anthelmintics: dose determination, dose confirmation and field efficacy studies. Special studies are also required to determine the persistent efficacy of an anthelmintic.

#### **1 - Dose Determination Studies**

Dose titration trials should from now on be referred to as dose determination studies, their purpose being to determine the dose rate to be recommended for the particular target animal. The studies may or may not be conducted using the final formulation. However, if not, any changes in the formulation should be scientifically justified.

When broad spectrum activity is claimed for an anthelmintic preparation, dose determination studies should contain a dose-limiting species within the claimed spectrum, and should be independent of whether the dose limiting species is a high or a low (= rare) prevalence species. The sponsor should select the parasites taking into consideration their impact on animal health. Confirmation of effectiveness against the species for which a claim is made, would be completed in the dose confirmation studies.

When only one parasite is claimed (e.g. *Dirofilaria immitis*), the discussion on the number of species and the dose limiter becomes irrelevant.

A minimum of three groups receiving different levels of anthelmintic treatment together with a group of untreated controls should be included in the trials e.g., 0, 0.5, 1 and 2x the anticipated dose. It is suggested that the range of doses should be selected on the basis of preliminary studies to encompass the approximate effective dose. The reason for the dose selected should be explained. For each selected parasite, groups of treated and untreated controls should consist of at least six (= recommended) adequately infected animals, but if there is any doubt about the level of infection then the number should be increased accordingly (see data analysis).

This phase of the testing should be conducted using adult parasites unless there is information that larvae of a particular parasite could be a dose-limiting stage or the proposed product claim is only targetting a specific parasite at the larval stage (e.g. *Dirofilaria immitis*). Dose determination studies may be conducted using natural infections, however induced infections are preferred. Both laboratory strains and recent field isolates (see glossary) can be used to develop induced infections.

#### **2 - Dose Confirmation Studies**

These studies should be conducted using the final formulation of the drug to be commercialized. The dose confirmation work should not be conducted on known drug resistant strains of parasites. To investigate effectiveness against adult parasites, naturally infected animals are preferred. However, induced infections using recent field isolates in one of the studies are acceptable. For rare parasite species, laboratory strains may be used and they

may be conducted outside the geographic location in which the product will be authorized for marketing. Dose confirmation for larval stages should be conducted using induced infections. The sponsor should explain deviations from this recommendation. Against inhibited stages only natural infections are recommended.

At least two controlled or, when appropriate, critical dose confirmation studies per individual claim are recommended (single or multiple infections). These studies should be conducted under conditions that are sufficiently representative of the various conditions under which the product will be authorised. In the event that in certain locations parasites are particularly rare then two trials from outside the location will be acceptable. Since the sensitivity of the parasites to treatment should be independent of the geographical location, additional confirmation studies from local regions are not justifiable. Such considerations shall be addressed in the confirmatory field trials. A dose determination study can be used in place of one of the confirmation studies, if the final formulation was used and administered under label recommendations.

For each study, at least six (= recommended) animals per treatment group should be adequately infected. The adequacy of the infection should be defined in the protocol phase. A sufficient number of infected animals should be examined before treatment of naturally infections to ensure that at least six (= recommended) adequately infected animals for the parasite or life stage of a parasite are present at the start of the trial (see recommendations for the calculation of effectiveness).

### **3 - Field Efficacy Studies**

These studies should be conducted using the final formulation of the drug product to be commercialized to confirm efficacy and safety. The number of field trials to be conducted and animals involved in each trial will depend on (1) the animal species, (2) the geographic location and (3) local/regional situations. The controls i.e. non treated animals or animals treated with a registered anthelmintic with a known profile, should equal a minimum of 25% of the treated animal numbers. Local/regional implies within a country and/or association with a climatic and/or management area (see also glossary). To achieve the requested numbers it is also acceptable to conduct multi-centre studies with sub-trials in each local/region. The request for additional (or fewer) studies, and/or animals (animal welfare considerations) by local regulatory authorities should be fully justified. The product should always be tested in the breed/age range/class/production type of animal intended to be treated as indicated on the labelling.

### **4 - Persistent Efficacy Studies**

Modern broad spectrum anti-parasitic compounds may show persistent effectiveness due to the presence of residual activity of either the parent compound, or the metabolites, in the treated animal. These claims can only be determined on the basis of actual worm counts and not on number of eggs per gram of faeces. Claims of activity of less than seven days should not be considered a persistent effect and claims should mention persistent efficacy for a certain number of days. The type of protocol depends on the animal species and will be discussed under the specific target species guidelines.

A minimum for a persistence claim (for each duration and parasite claim) should include two trials (with worm counts) each with a non-treated and treated group. At least six animals (= recommended) per treatment group should be adequately infected. The adequacy of the infection should be defined in the protocol phase. Persistence claims will only be granted on a species-by-species basis.

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## GLOSSARY

**ADEQUATE INFECTION:** Natural or induced infection level defined in the study protocol that will allow the evaluation of the therapeutic effectiveness of the drug when comparing parasitological parameters (e.g., number of parasites) in medicated and control animals.

**ALIQOT SIZE:** A sample (known volume) of gastrointestinal or other (lung etc) content collected to determine the number of parasites.

**CLAIM:** A parasite species or genus (adult and/or larvae) listed on the labelling with proven susceptibility (90% or better effectiveness) to an anthelmintic drug

**CONTROLLED TEST:** A procedure to study the effectiveness of a drug using two groups: a control and at least one treated group of experimental animals. Adequately parasitized animals are included in each treated and control group; after a suitable period of time after treatment the animals are necropsied and the parasites are enumerated and identified. The effectiveness of the compound is calculated as follows:  $100 \left[ \frac{\text{GM of N}^\circ \text{ of parasites in control group} - \text{GM of N}^\circ \text{ parasites in treated animals}}{\text{GM of N}^\circ \text{ of parasites in control animals}} \right]$  is equal to % Effectiveness for the parasite or life stage (GM = geometric mean). This test is the most widely used and accepted when the sample size is the same.

**CRITICAL TEST:** A procedure whereby the number of parasites recovered from an animal after the treatment is added to the number counted in the intestine at necropsy which are considered to be the total number of parasites in the animal at the time of treatment. The effectiveness is calculated as follows:  $\left[ \frac{\text{N}^\circ \text{ of parasites expelled}}{(\text{N}^\circ \text{ of parasites expelled}) + (\text{N}^\circ \text{ of parasites remaining})} \right] \times 100$  is equal to % effectiveness in the individual animal.

**DOSE CONFIRMATION STUDY:** *In-vivo* study to confirm the effectiveness of a selected drug dose and formulation; may be conducted in the laboratory or in the field.

**DOSE DETERMINATION STUDY:** *In-vivo* study conducted to determine the most appropriate dose or range of effectiveness of a veterinary drug.

**DOSE-LIMITING PARASITE:** A parasite that will be identified during dose determination studies that will identify the dosage of the drug at which it shows 90% effectiveness. Any lower concentration of the product will show an effectiveness below 90% for the dose-limiting parasite even though it will adequately treat other parasites (90% or better effectiveness) in the host.



**EFFECTIVENESS:** The degree to which the manufacturers claims on the labelling have been supported by adequate data i.e. providing control of at least 90% on the basis of the calculation of geometric means using pooled data from controlled studies.

**FIELD EFFICACY STUDY:** Larger scale study to determine effectiveness and safety of a veterinary drug under actual use conditions.

**GCP:** Good Clinical Practice: A set of recommendations intended to promote the quality and validity of test data. It covers the organizational process and the conditions under which studies are planned, performed, monitored, recorded and reported.

**GEOGRAPHICAL LOCATION:** A subdivision where the guidelines will be implemented: Japan, European Union, USA and Australia/New Zealand.

**FIELD ISOLATE:** A collection of a sub-population of helminths for the conduct of drug effectiveness tests isolated from the field less than 10 years ago. The helminths are considered representative of current parasitic infections in the field and have been characterized (source, date, location, previous anthelmintic exposure and maintenance procedures).

**LABORATORY STRAIN:** A sub-population of helminths that has been isolated from the field at least 10 years ago, characterized and has been segregated in the laboratory based on a particular property which makes it unique for research areas such as resistance to certain antiparasitic compounds.

**RARE PARASITE:** Low prevalence parasite species which may or may not be able to produce significant morbidity and clinical symptoms, usually limited to certain geographic locations.

**REGION:** An area within a geographical location defined by climatic conditions, target animal husbandry, and parasite resistance prevalence.

**VICH:** Veterinary International Cooperation on Harmonization.

# **Guidance for Industry**

## **EFFICACY OF ANTHELMINTICS: SPECIFIC RECOMMENDATIONS FOR BOVINES**

### **DRAFT GUIDANCE**

This guidance is intended to standardize and simplify methods used in the evaluation of new anthelmintics submitted for approval to the European Union, Japan, and the United States.

This guidance represents the agency's current thinking on the efficacy of anthelmintics concerning bovine products regulated by the Center of Veterinary Medicine, FDA. It does not create or confer any rights for or on any person and does not operate to bind FDA or the public. An alternative approach may be used if such approach satisfies the requirements of the applicable statute, regulation, or both.

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**U.S. Department of Health and Human Services  
Food and Drug Administration  
Center for Veterinary Medicine  
July 1999**

# **EFFICACY OF ANTHELMINTICS: SPECIFIC RECOMMENDATIONS FOR BOVINES**



Recommended for Consultation  
at Step 4 of the VICH Process  
in February 1999  
(written procedure)  
by the VICH Steering Committee

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# **EFFICACY OF ANTHELMINTICS: SPECIFIC RECOMMENDATIONS FOR BOVINES**

**Endorsed by the VICH Steering Committee at Step 3 of the VICH Process**

**In February 1999 by written procedure**

## **INTRODUCTION**

These guidances for bovines were developed by the Working Group established by the Veterinary International Co-operation on Harmonization (VICH), Anthelmintic Guidances. They should be read in conjunction with the VICH Efficacy of Anthelmintics: General Recommendations (EAGR) which should be referred to for discussion of broad aspects for providing pivotal data to demonstrate product anthelmintic effectiveness. The present document is structured similarly to the EAGR with the aim of simplicity for readers comparing both documents.

The guidances for bovines are part of this EAGR and the aim is (1) to be more specific for certain specific issues for bovines not discussed in the overall guidances; (2) to highlight differences with the EAGR on efficacy data recommendations and (3) to give explanations for disparities with the EAGR.

It is also important to note that technical procedures to be followed in the studies are not the aim of this guidance. We recommend to the sponsors to refer to the pertinent procedures described in detail in other published documents e.g. WAAVP Second Edition of Guidances for Evaluating the Efficacy of Anthelmintics in Ruminants (Bovine, Ovine, Caprine) Veterinary Parasitology **58**: 181-213, 1995.

## **A. General Elements**

### **1 - The evaluation of effectiveness data**

Only controlled tests based on parasite counts of adults/larvae are recommended both for the dose determination and dose confirmation studies, since critical tests generally are not considered to be reliable for ruminants. Egg counts/larval identification is the preferred method to evaluate the effectiveness in field studies. Long-acting or sustained-release products should be subject to the same evaluation procedures as other therapeutic anthelmintics. Adequate parasite infection should be defined in the protocol according to regional prevalence or historic and/or statistical data.

### **2 - Use of natural or induced infections**

Dose determination studies generally should be conducted using induced infections with either laboratory or recent field isolates.

Dose confirmation studies should be conducted using naturally infected animals which can have superimposed induced infections of certain parasites that will not interfere with the resident intestinal population. This procedure will allow a wide range of parasites. For claims against hypobiotic larvae, only natural infections should be considered. Sponsors should aim for a maximum period of accumulation of hypobiotic larvae for the particular parasite species being targeted in trial animals. This will be area or regionally dependent. Specific details on area or regional situations should be obtained from experts on a case by case basis. In all cases, animals need to be housed (to preclude reinfection) for a minimum of 1 week before treatment.

Persistent efficacy studies should be conducted using induced infections with recent field isolates.

The history of the parasites used in the induced infection studies should be included in the final report.

### 3 - Number of infective parasitic forms recommended for induced infections.

The number to be used is approximate and will depend on the isolate that is used. The final number of larvae used in the infection should be included in the final report. Table 1 shows the range of numbers recommended.

**Table 1 - Number of infective stages used to produce adequate infections in cattle for anthelmintic evaluation.**

Parasites	VICH
Abomasum	
<i>Haemonchus placei</i>	5,000 - 10,000
<i>Ostertagia ostertagi</i>	10,000 - 30,000
<i>Trichostrongylus axei</i>	10,000 - 30,000
Intestines	
<i>Cooperia oncophora</i>	10,000 - 30,000
<i>C. punctata</i>	10,000 - 15,000
<i>T. colubriformis</i>	10,000 - 30,000
<i>Nematodirus spathiger</i>	3,000 - 10,000
<i>N. helvetianus</i>	3,000 - 10,000
<i>N. battus</i>	3,000 - 6,000
<i>Oesophagostomum radiatum</i>	1,000 - 2,500
<i>O. venulosum</i>	1,000 - 2,000
<i>Chabertia ovina</i>	500 - 1,500
<i>Bunostomum phlebotomum</i>	500 - 1,500
<i>Strongyloides papillosus</i>	1,000 - 200,000
<i>Trichuris</i> spp.	1,000
Lungs	
<i>Dictyocaulus viviparus</i>	500 - 6,000
Liver	
<i>Fasciola hepatica</i> (metacercaria)	
Adult cattle	1,000
Young cattle	500-1,000

### 4 - Recommendations for the calculation of effectiveness

#### 4.1. Criteria to grant a claim

To be granted a claim the following pivotal data should be included:

- Two dose confirmation studies conducted with a minimum of six adequately infected non-medicated animals (control group) and six adequately infected medicated animals (treated group).
- The differences in parasite counts between treated and control animals should be statistically significant ( $p < 0.05$ );
- Infection of the animals in the study will be deemed adequate based on historical, parasitological and/or statistical criteria.

This effectiveness standard (= 90% or higher) is based on helminth removal from the host. If, however, the focus of regional anthelmintic treatment is to target prevention of pasture contamination due to the epizootology of gastrointestinal helminth parasites, then a higher minimum efficacy standard may be applied. Sponsors should discuss such situations with the regulatory authorities prior to commencement of trial work.

#### 4.2 Number of animals (dose determination, dose confirmation and persistency trials)

The minimum number of animals used per experimental group is a critical point. Although the number of animals will depend on the possibility to process the data statistically according to the adequate statistical analysis, it has been recommended, to achieve harmonization, that the inclusion of at least six animals in each experimental group is a minimum.

In cases where there are several studies none of which have six adequately infected animals in the control group (for example, important rare parasites), the results obtained could be pooled to accumulate 12 animals in the studies; and statistical significance calculated. If the difference are significant ( $p < 0.05$ ), effectiveness may be calculated and if the infection is deemed adequate, the claim may be granted. Sampling techniques and estimation of worm burden should be similar among laboratories involved in the studies to allow adequate and meaningful extrapolation of the results to the population.

#### **4.3 Adequacy of infection**

Concerning minimum adequate number of helminths, the decision will be made when the final report is submitted based on statistical and historical data, literature review, or expert testimony. The range of bovine helminths (adults) that has been considered adequate to grant a claim will vary according to the species. Generally the minimal mean number of nematodes considered to be adequate is 100. Lower mean counts are to be expected with *Bunostomum* spp., *Oesophagostomum* spp., *Trichuris* spp., and *Dictyocaulus* spp. For *Fasciola* spp. minimal mean counts of 20 adults may be considered adequate.

#### **4.4 Label claims**

Adult or L4 parasites: The term immature on the labelling is not acceptable. For adult claims as a general rule, the treatment should not be administered earlier than 21 to 25 days after infection; optimum for most species is 28 to 32 days. Major exceptions are *Oesophagostomum* spp. (34 to 49 days), *Bunostomum* spp. (52 to 56 days), *Strongyloides papillosus* (14 to 16 days) and *Fasciola* spp. (8 to 12 weeks).

For L4 claims, treatments should be given as a general rule 7 days after infection with the following exceptions: 3 to 4 days for *Strongyloides papillosus*, 5 to 6 days for *Haemonchus* spp., *Trichostrongylus* spp. and *Cooperia* spp., 8 to 10 days for *Nematodirus* spp. and 15 to 17 days for *Oesophagostomum* spp. For early immature *Fasciola* spp., treatments should be given 1 to 4 weeks after infection and for late immatures at 6 to 8 weeks.

### **5. Treatment procedures**

5.1 - The method of administration (oral, parenteral, topical, slow-release etc.), formulation and extent of activity of a product will influence the protocol design. It is advisable to consider the weather and animal relationship with regard to effectiveness of topical formulations. Slow-release products should be tested over the entire proposed effective time unless additional information suggests that this is unnecessary. e.g. blood levels demonstrate steady state at all points of the proposed therapeutic period.

5.2 - Treatment Route. When the drug is to be administered in the water or in a premix, it should be done as much as possible following the labelling recommendations. Palatability studies may be required for medicated premixes. Samples of medicated water or feed should be collected to confirm drug concentration. The amount of medicated product provided to each animal should be recorded to ensure that the treatment satisfies the label recommendations. For products used topically, the impact of weather (e.g. rainfall, UV light), and coat length impact should be included in the evaluation of the effectiveness of the product.

### **6 - Animal selection, allocation and handling**

Test animals should be clinically healthy and representative of the age, sex, and class for which the claim of the test anthelmintic is to be made. In general, the animals should be ruminating, and older than 3 months of age. Animals should be assigned randomly to each treatment. Blocking in replicates by weight, sex, age, and/or exposure to parasites may aid in reducing trial variance. Faecal egg/larval counts are also useful to allocate the experimental animals.

For induced infections, the use of helminth naive animals is recommended. Animals not raised in a helminth-free environment should be treated with an approved anthelmintic drug to remove pre-existing infections followed by faecal examination to determine that the animals are helminth free.

Good husbandry practices should be followed and the animals should be vaccinated according to local practices. This information should be provided in the final report. A minimum seven-day

acclimatisation period is recommended. Housing and feed-water should be adequate according to the geographical location. Animals should be monitored daily to determine adverse reactions.

## **B. Specific evaluation studies**

### **1 - Dose Determination Studies**

### **2 - Dose Confirmation Studies**

At least two dose confirmation studies are recommended to support each claim: adult, larvae and when applicable hypobiotic larvae. For additional descriptions of the procedures refer to EAGR.

### **3 - Field Efficacy Studies**

### **4 - Persistent Efficacy Studies**

Two basic study designs have been used to pursue persistent efficacy claims. One using a single challenge, another using multiple daily challenges following treatment. For consistency of interpretation of results, a standardised study design is recommended using multiple daily challenges, as this most closely mimics what occurs in nature.

Two trials (with worm counts) are recommended for a persistent efficacy claim (for each duration and helminth claim ) each with a non-treated and one or more treated groups. At least six animals in the control group should be adequately infected. Persistent efficacy claims should only be granted on a species-by-species basis.

In the protocol using multiple daily challenges, different groups of animals are treated and exposed to a daily natural or induced challenge for 7, 14, 21 or more days after the treatment, then at approximately three weeks after the last challenge ( or earlier ) the animals are examined for parasite burden.

Persistent efficacy claims should be supported by a minimum 90% effectiveness based on geometric means.

# **Guidance for Industry**

## **EFFICACY OF ANTHELMINTICS: SPECIFIC RECOMMENDATION FOR OVINES**

### **DRAFT GUIDANCE**

This guidance is intended to standardize and simplify methods used in the evaluation of new anthelmintics submitted for approval to the European Union, Japan, and the United States.

This guidance represents the agency's current thinking on the efficacy of anthelmintics concerning ovine products regulated by the Center of Veterinary Medicine, FDA. It does not create or confer any rights for or on any person and does not operate to bind FDA or the public. An alternative approach may be used if such approach satisfies the requirements of the applicable statute, regulation, or both.

Comments and suggestions regarding the document should be submitted to Dockets Management Branch (HFA-305), Food and Drug Administration, 5630 Fishers Lane, Rm. 1061, Rockville, MD 20852. All comments should be identified with the Docket No. 99N-[insert number when assigned].

For questions regarding this draft document, contact Thomas Letonja, Center for Veterinary Medicine, (HFV-130), Food and Drug Administration, 7500 Standish Place, Rockville, MD 20855, 301-594-1656, E-mail: [tletonja@cvm.fda.gov](mailto:tletonja@cvm.fda.gov).

**U.S. Department of Health and Human Services  
Food and Drug Administration  
Center for Veterinary Medicine  
July 1999**



# **EFFICACY OF ANTHELMINTICS: SPECIFIC RECOMMENDATIONS FOR OVINES**

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Recommended for Consultation  
at Step 4 of the VICH Process  
in February 1999  
(written procedure)  
by the VICH Steering Committee

THIS GUIDANCE HAS BEEN DEVELOPED BY THE APPROPRIATE VICH EXPERT WORKING GROUP AND IS SUBJECT TO CONSULTATION BY THE PARTIES, IN ACCORDANCE WITH THE VICH PROCESS. AT STEP 7 OF THE PROCESS THE FINAL DRAFT WILL BE RECOMMENDED FOR ADOPTION TO THE REGULATORY BODIES OF THE EUROPEAN UNION, JAPAN AND USA.

# **EFFICACY OF ANTHELMINTICS: SPECIFIC RECOMMENDATIONS FOR OVINES**

**Endorsed by the VICH Steering Committee at Step 3 of the VICH Process**

**In February 1999 by written procedure**

## **INTRODUCTION**

These guidances for ovines were developed by the Working Group established by the Veterinary International Co-operation on Harmonization (VICH), Anthelmintic Guidances. They should be read in conjunction with the VICH Efficacy of Anthelmintics: General Recommendations (EAGR) which should be referred to for discussion of broad aspects for providing pivotal data to demonstrate product anthelmintic effectiveness. The present document is structured similarly to the EAGR with the aim of simplicity for readers comparing both documents.

The guidances for ovines are part of this EAGR and the aim is (1) to be more specific for certain specific issues for ovines not discussed in the overall guidances; (2) to highlight differences with the EAGR on efficacy data recommendations and (3) to give explanations for disparities with the EAGR.

It is also important to note that technical procedures to be followed in the studies are not the aim of this guidance. We recommend to the sponsors to refer to the pertinent procedures described in details in other published documents e.g. WAAVP Second Edition of Guidances for Evaluating the Efficacy of Anthelmintics in Ruminants (Bovine, Ovine, Caprine) Veterinary Parasitology **58**: 181-213, 1995.

## **A. General Elements**

### **1 - The evaluation of effectiveness data**

Only controlled tests based on parasite counts of adults/larvae are recommended both for the dose determination and dose confirmation studies, since critical tests generally are not considered to be reliable for ruminants. Egg counts/larval identification is the preferred method to evaluate the effectiveness in field studies. Long-acting or sustained-release products should be subject to the same evaluation procedures as other therapeutic anthelmintics. Adequate parasite infection should be defined in the protocol according to regional prevalence or historic and/or statistical data.

### **2 - Use of natural or induced infections**

Dose determination studies generally should be conducted using induced infections with either laboratory or recent field isolates.

Dose confirmation studies should be conducted using naturally infected animals which can have superimposed induced infections of certain parasites that will not interfere with the resident intestinal population. This procedure will allow a wide range of parasites. For claims against hypobiotic larvae, only natural infections should be considered. Sponsors should aim for a maximum period of accumulation of hypobiotic larvae for the particular parasite species being targeted in trial animals. This will be area or regionally dependent. Specific details on area or regional situations should be obtained from experts on a case by case basis. In all cases, animals need to be housed (to preclude reinfection) for a minimum of 1 week before treatment.

Persistent efficacy studies should be conducted using induced infections with recent field isolates.

The history of the parasites used in the induced infection studies should be included in the final report.

### 3 - Number of infective parasitic forms recommended for induced infections.

The number to be used are approximate and will depend on the isolate that is used. The final number of larvae used in the infection should be included in the final report. Table 1 shows the range of numbers recommended.

**Table 1 - Number of infective stages used to produce adequate infections in sheep for anthelmintic evaluation**

Parasites	VICH
<b>Abomasum</b>	
<i>Haemonchus contortus</i>	400 – 4,000
<i>Teladorsagia circumcincta</i>	6,000 – 10,000
<i>Trichostrongylus axei</i>	3,000 – 6,000
<b>Intestines</b>	
<i>Cooperia curticei</i>	3,000 – 6,000
<i>T. colubriformis</i> & <i>T. vitrinus</i>	3,000 – 6,000
<i>Nematodirus</i> spp.	3,000 – 6,000
<i>Oesophagostomum</i> spp.	500 – 1,000
<i>Chabertia ovina</i>	800 – 1,000
<i>Bunostomum trigonocephalum</i>	500 – 1,000
<i>Strongyloides papillosus</i>	80,000
<i>Gaigeria pachyscelis</i>	400
<i>Trichuris</i> spp.	1,000
<b>Lungs</b>	
<i>Dictyocaulus filaria</i>	1,000 – 2,000
<b>Liver</b>	
<i>Fasciola hepatica</i> (metacercaria)	100 - 200 (chronic) 1,000 – 1,500 (acute)

### 4 - Recommendations for the calculation of effectiveness

#### 4.1. Criteria to grant a claim

To be granted a claim the following pivotal data should be included:

- Two dose confirmation studies conducted with a minimum of six adequately infected non-medicated animals (control group) and six adequately infected medicated animals (treated group);
- The differences in parasite counts between treated and control animals should be statistically significant ( $p < 0.05$ );
- Effectiveness should be 90% or higher calculated using transformed (geometric means) data.
- The infection of the animals in the study will be deemed adequate based on historical, parasitological and/or statistical criteria.

This effectiveness standard (= 90% or higher) is based on helminth removal from the host. If, however, the focus of regional anthelmintic treatment is to target prevention of pasture contamination due to the epizootology of gastrointestinal helminth parasites, then a higher minimum efficacy standard may be applied. Sponsors should discuss such situations with the regulatory authorities prior to commencement of trial work.

#### 4.2 Number of animals (dose determination, dose confirmation and persistency trials)

The minimum number of animals used per experimental group is a critical point. Although the number of animals will depend on the possibility to process the data statistically according to adequate statistical analysis, it has been recommended, to achieve harmonization, that the inclusion of at least six animals in each experimental group is a minimum.

In cases where there are several studies none of which have six adequately infected animals in the control group (for example, important rare parasites), the results obtained could be pooled to accumulate 12 animals in the studies; and statistical significance calculated. If the difference are significant ( $p < 0.05$ ), effectiveness may be calculated and if the infection is deemed adequate, the claim may be granted. Sampling techniques and estimation of worm burden should be similar among laboratories involved in the studies to allow adequate and meaningful extrapolation of the results to the population.

#### **4.3 Adequacy of infection**

Concerning minimum adequate number of helminths, the decision will be made when the final report is submitted based on statistical and historical data, literature review, or expert testimony. The range of ovine helminths (adults) that has been considered adequate to grant a claim will vary according to the species. Generally the minimal mean number of nematodes considered to be adequate is 100. Lower mean counts are to be expected with *Bunostomum* spp, *Oesophagostomum* spp., *Trichuris* spp., and *Dictyocaulus* spp. For *Fasciola* spp. minimal mean counts of 20 adults may be considered.

#### **4.4 Label claims**

Adult or L4 parasites: The term immature on the labelling is not acceptable. For adult claims as a general rule, the treatment should not be administered earlier than 21 to 25 days after infection; optimum for most species is 28 to 32 days. Major exceptions are *Oesophagostomum* spp. (28 to 41 days), *Bunostomum* spp. (52 to 56 days), *Strongyloides papillosus* (14 to 16 days) and *Fasciola* spp. (8 to 12 weeks).

For L4 claims, treatments should be given as a general rule 7 days after infection with the following exceptions: 3 to 4 days for *Strongyloides papillosus*, 5 to 6 days for *Haemonchus* spp., *Trichostrongylus* spp. and *Cooperia* spp., 8 to 10 days for *Nematodirus* spp., and 15 to 17 days for *Oesophagostomum* spp. For early immature *Fasciola* spp., treatments should be given 1 to 4 weeks after infection and for late immatures at 6 to 8 weeks.

### **5. Treatment procedures**

5.1 - The method of administration (oral, parenteral, topical, slow-release etc.), formulation and extent of activity of a product will influence the protocol design. It is advisable to consider the weather and animal relationship with regard to effectiveness of topical formulations. Slow-release products should be tested over the entire proposed effective time unless additional information suggests that this is unnecessary. e.g. blood levels demonstrate steady state at all points of the proposed therapeutic period.

5.2 - Treatment Route. When the drug is to be administered in the water or in a premix, it should be done as much as possible following the labelling recommendations. Palatability studies may be required for medicated premixes. Samples of medicated water or feed should be collected to confirm drug concentration. The amount of medicated product provided to each animal should be recorded to ensure that the treatment satisfies the label recommendations. For products used topically, the impact of weather (e. g. rainfall, UV light), and coat length impact should be included in the evaluation of the effectiveness of the product.

### **6 - Animal selection, allocation and handling**

Test animals should be clinically healthy and representative of the age, sex, and class for which the claim of the test anthelmintic is to be made. In general the animals should be ruminating, and older than 3 months of age. Animals should be assigned randomly to each treatment. Blocking in replicates by weight, sex, age, and/or exposure to parasites may aid in reducing trial variance. Faecal egg/larval counts are also useful to allocate the experimental animals.

For induced infections, the use of helminth naive animals is recommended. Animals not raised in a helminth-free environment should be treated with an approved anthelmintic drug to remove pre-existing infections followed by faecal examination to determine that the animals are helminth free.

Good husbandry practices should be followed and the animals should be vaccinated according to local practices. This information should be provided in the final report. A minimum seven-day acclimatisation period is recommended. Housing and feed-water should be adequate according to the geographical location. Animals should be monitored daily to determine adverse reactions.

## **B. Specific evaluation studies**

### **1 - Dose Determination Studies**

### **2 - Dose Confirmation Studies**

At least two dose confirmation studies are recommended to support each claim: adult, larvae and when applicable hypobiotic larvae. For additional descriptions of the procedures refer to EAGR.

### **3 - Field Efficacy Studies**

### **4 - Persistent Efficacy Studies**

Two basic study designs have been used to pursue persistent efficacy claims. One using a single challenge, another using multiple daily challenges following treatment. For consistency of interpretation of results, a standardised study design is recommended using multiple daily challenges, as this most closely mimics what occurs in nature.

Two trials (with worm counts) for a persistent efficacy claim (for each duration and helminth claim) each with a non-treated and one or more treated groups. At least six animals in the control group should be adequately infected. Persistent efficacy claims should only be granted on a species-by-species basis.

In the protocol using multiple daily challenges, different groups of animals are treated and exposed to a daily natural or induced challenge for 7, 14, 21 or more days after the treatment, then at approximately three weeks after the last challenge ( or earlier ) the animals are examined for parasite burden.

Persistent efficacy claims should be supported by a minimum 90% effectiveness based on geometric

# **Guidance for Industry**

## **EFFICACY OF ANTHELMINTICS: SPECIFIC RECOMMENDATIONS FOR CAPRINES**

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This guidance represents the agency's current thinking on the efficacy of anthelmintics concerning caprine products regulated by the Center of Veterinary Medicine, FDA. It does not create or confer any rights for or on any person and does not operate to bind FDA or the public. An alternative approach may be used if such approach satisfies the requirements of the applicable statute, regulation, or both.

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**U.S. Department of Health and Human Services  
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The guidances for caprines are part of this EAGR and the aim is (1) to be more specific for certain specific issues for caprines not discussed in the overall guidances; (2) to highlight differences with the EAGR on efficacy data recommendations and (3) to give explanations for disparities with the EAGR.

It is also important to note that technical procedures to be followed in the studies are not the aim of this guidance. We recommend to the sponsors to refer to the pertinent procedures described in details in other published documents e.g. WAAVP Second Edition of Guidances for Evaluating the Efficacy of Anthelmintics in Ruminants (Bovine, Ovine, Caprine) Veterinary Parasitology **58**: 181-213, 1995.

Since caprines are considered a minor species, the cost of a full development program may preclude the development of products for this species, and since the helminth species of caprines are identical to those of ovines, it is recommended that consideration be given to an abbreviated schedule of studies to obtain approval.

## **A. General Elements**

### **1 - The evaluation of effectiveness data**

Only controlled tests based on parasite counts of adults/larvae are recommended both for the dose determination and dose confirmation studies, since critical tests generally are not considered to be reliable for ruminants. Egg counts/larval identification is the preferred method to evaluate the effectiveness in field studies. Long-acting or sustained-release products should be subjected to the same evaluation procedures as other therapeutic anthelmintics. Adequate parasite infection should be defined in the protocol according to regional prevalence or historic and/or statistical data.

### **2 - Use of natural or induced infections**

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## 4 - Recommendations for the calculation of effectiveness

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### **5. Treatment procedures**

5.1 - The method of administration (oral, parenteral, topical, slow-release etc.), formulation and extent of activity of a product will influence the protocol design. It is advisable to consider the weather and animal relationship with regard to effectiveness of topical formulations. Slow-release products should be tested over the entire proposed effective time unless additional information suggests that this is unnecessary. e.g. blood levels demonstrate steady state at all points of the proposed therapeutic period.

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### **6 - Animal selection, allocation and handling**

Test animals should be clinically healthy and representative of the age, sex, and class for which the claim of the test anthelmintic is to be made. In general the animals should be ruminating, and older than 3 months of age. Animals should be assigned randomly to each treatment. Blocking in replicates

by weight, sex, age, and/or exposure to parasites may aid in reducing trial variance. Faecal egg/larval counts are also useful to allocate the experimental animals.

For induced infections the use of helminth naive animals is recommended. Animals not raised in a helminth-free environment should be treated with an approved anthelmintic drug to remove pre-existing infections followed by faecal examination to determine that the animals are helminth free.

Good husbandry practices should be followed and the animals should be vaccinated according to local practices. This information should be provided in the final report. A minimum seven-day acclimatisation period is recommended. Housing and feed-water should be adequate according to the geographical location. Animals should be monitored daily to determine adverse reactions.

## **B. Specific evaluation studies**

### **1 - Dose Determination Studies**

A dose determination trial and/or sheep/goat comparative pharmacokinetic studies where appropriate, should verify if the dose selected is effective in goats.

### **2 - Dose Confirmation Studies**

At least two dose confirmation studies including at least the dose limiting helminth(s) and stages in each study are recommended. If efficacy is demonstrated for the test parasites a claim can be supported for all the helminth species claimed for the sheep host. For additional descriptions of the procedures refer to EAGR.

### **3 - Field Efficacy Studies**

### **4 - Persistent Efficacy Studies**

Two basic study designs have been used to pursue persistent efficacy claims. One using a single challenge, another using multiple daily challenges following treatment. For consistency of interpretation of results a standardised study design is recommended using multiple daily challenges, as this most closely mimics what occurs in nature.

Two trials (with worm counts) are recommended for a persistent efficacy claim (for each duration and helminth claim) each with a non-treated and one or more treated groups. At least six animals in the control group should be adequately infected. Persistent efficacy claims should only be granted on a species-by-species basis.

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Persistent efficacy claims should be supported by a minimum 90% effectiveness based on geometric means.